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Factsheet

NO TILL GRAIN DRILLS

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The ultimate goal of any planting operation is to place the seed in a soil environment which is conducive to germination and subsequent growth. Under no-till conditions, the ability of the planting unit to fulfill this goal becomes a critical element in the success of the system.

Conventional grain drills are unable to achieve the objectives of the planting operation in untilled soil under most conditions. A no-till grain drill must be designed to obtain uniform seed depth, seed spacing, and good seed-to-soil contact with soil firmed over the seed but not compacted. The machine must also be designed to handle crop residues left from the previous crop. The drill must be able to cut and size the residue providing for adequate trash flow through the unit without plugging.

COMPONENTS

Many of the components of a no-till grain drill remain the same as a conventional drill. Units for metering seed and fertilizer will perform equally well regardless of tillage methods. Other components may need to be modified or added.

Structural Strength Drills designed to operate in no-till conditions require enhanced structural strength. Untilled soil is far more resistant to penetration, thus more pressure must be placed on the unit to achieve penetration and adequate seed depth. Weight becomes a critical factor. A total of 400 pounds of weight per foot of drill width may be required to facilitate adequate penetration under hard, dry soil conditions. The unit must have this weight inherent in its design, or be capable of having additional weight added to achieve this goal, without overstressing the frame of the unit. Spring loading of coulters and seed openers is essential, in order to avoid damage from obstructions. These springs must also be capable of exerting sufficient pressure to keep these parts in the ground even under hard conditions. Therefore, proper adjustment of a rugged drill is essential under no-till conditions.

Coulters A wide variety of coulters is available for use on these specialized drills. Each of these coulters is suited to a specific type of drill, or a specific soil moisture or planting requirement.

Coulters range from flat, smooth blades used strictly to cut residue, to the wide, fluted coulter used to perform limited tillage and soil fracturing ahead of the seed placement unit. The more common coulter types are pictured in Figures 2 and 3.

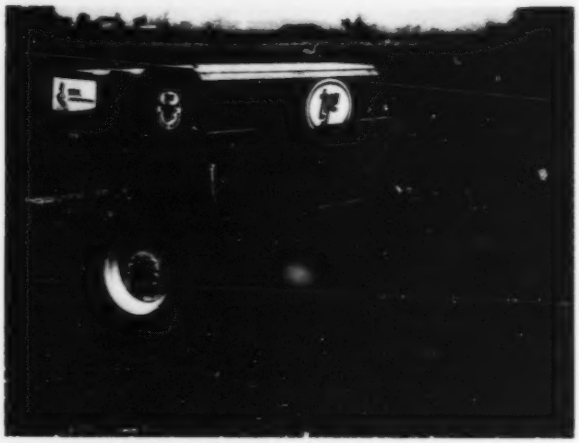

Figure 1. A common no-till grain drill showing the heavy frame and some additional weights.

Figure 2. Coulter types A: a ripple or plough blade (also called a duraflute)
B: a 1" fluted (or wavy) blade
C: a 2" futed (or wavy) blade
The 2" fluted blade pictured is only 14" in diameter, in comparison to the other blades at 18" in diameter.

Coulter blades 18" in diameter work well cutting through residue. If coulter blades are either too large or too small, there is a tendency for residue to push ahead of the units or hairpin in the seed trench.

Figure 3. Bubble coulters mounted on a drill.

The width of coulters also affects the planting operation. The wider the coulter, the more tillage effect it will have on the soil. Under wet soil conditions, this amount of tillage may not be desirable. Wider coulters will also throw more soil, and may have to be operated at lower ground speeds. Thus soil type, soil moisture and the crop being planted all have a bearing on which coulter is best suited for any given situation.

Seed Placement There are three basic types of seed placement units used to achieve uniform seed depth and maintain trash flow on no-till grain drills: (a) the triple disc, (b) the single disc plus shoe, and (c) the hoe type. All three types are available in Ontario, and have been used successfully. However, the triple disc unit has gained more popularity than the other two types.

All three types of seed placement units increase their ability to handle residue by staggering the units. Under Ontario conditions, a single gang of planting units with row spacings less than 10" will experience plugging problems in heavy residue situations. The narrower row spacing becomes, the more units will need to be staggered in order to facilitate trash flow. However, this also lengthens the unit and makes it more difficult to maintain the balance and down pressure of the entire unit. As the unit increases in length, it will also experience more difficulty with tracking around corners. This often necessitates a compromise between desired row width and maintaining proper trash flow through the unit.

The Triple Disc Opener The Triple Disc Opener utilizes a lead coulter which is designed to size residue, as well as open a slot or prepare a narrow band of tilled soil for the seed placement unit that follows. The following seed placement unit is generally a conventional double disc opener. Heavier down pressure springs are often added to the double disc opener in order to maintain penetration and seed depth. Under these conditions it is beneficial to have the discs of the double disc opener slightly offset, as this allows them to slice through the soil more effectively. The angle between the two blades should also be very acute, as this also facilitates penetration.

As the triple disc unit utilizes conventional style double disc openers for seed placement, there is an opportunity to adapt existing drills to this system. A caddy is built to carry the lead coulters for tillage and residue sizing, and the conventional drill is hooked on behind this. This offers the potential for a low cost no-till drill system, but is not without its drawbacks. Tracking of the drill behind the caddy is generally less than optimal. Maintaining sufficient down pressure on the units may also require extra down pressure springs.

The Single Disc Opener The single disc opener uses one coulter, with an attached shoe functioning as the seed placement mechanism. The coulter is utilized both to cut and size residue, and to open a slot for seed placement. The shoe is attached in close proximity to the coulter to facilitate penetration and seeding depth. Proper adjustment of the distance between the shoe and the coulter is important for proper drill operation. The shoe may be on just one side of a slightly angled coulter, or may be a small "wing" on each side of a straight running coulter giving rise to an inverted "T" shaped slot, with soil fracturing accompanying this system.

The Hoe Type Opener The hoe type drill is less common in no-till systems in Ontario. A single disc is used to size residue and facilitate trash flow, followed by a hoe type opener for seed placement. There is often a considerable distance between the coulter and the hoe, making these units somewhat longer than most other no-till drills.

Press Wheels In order to obtain favorable seed to soil contact, the use of a press wheel becomes imperative. Press wheels are an option on conventional drills, but under no-till conditions they become an integral part of the system. A wide array of press wheels are produced by various drill manufacturers, ranging from cast iron to pneumatic, and from single wheeled to triple wheeled units. Several styles of press wheels are pictured in Figure 4.

Press wheels serve three main functions: (a) they ensure good seed to soil contact, (b) they provide closure of the seed trench, and (c) they give depth control to the seeding unit. Good seed to soil contact is essential for rapid germination and growth. Press wheels provide this environment by firming soil around the seed. With the firm soil conditions associated with no-till, closure of the seed trench becomes more difficult. It is important for the press wheel to close the trench, as otherwise the seed will be left exposed and the soil may dry out, preventing germination.

Figure 4. Many manufacturers offer a wide selection of press wheels for use on no-till grain drills. Several options are pictured here.

Press wheels also aid in achieving a uniform seeding depth. Due to the variable nature of most soils in Ontario, any given weight and down pressure combination will seldom suit the conditions of an entire field. By setting the drill to function properly in the hardest conditions of the field, seeding depth will often be too great in other parts of the field. The press wheel acts to hold the seeding unit out of the ground in easier soils, while allowing sufficient down pressure for penetration elsewhere, thus maintaining uniform seeding depth.

FURTHER CONSIDERATIONS

The success of any system depends both on the ability of the equipment to operate under changing conditions, and the ability of the producer to operate within the limits of his soil conditions and cropping programs. The most capable drill will fail when operated on soils which are too wet. However, a twenty-year-old conventional drill may function very well to plant winter wheat after a soybean crop. The fact that the operator must work within the limits of the system cannot be stressed enough.

Often, attention to small details will have a great bearing on the success of the system. Crop residue which is left in piles or windrows behind the combine, rather than spread evenly, will inevitably interfere with the operation of the drill. A bolt which protrudes 1/2" further into the trash flow tunnel than necessary will predispose the unit to plugging. The use of the wrong coulter may prevent adequate seeding depth. The operator must constantly assess the performance of the equipment, and make adjustments accordingly.

The technology is now available to make no-till grain drills a reliable part of the crop production package in Ontario. It remains only for the producer to develop the management techniques to utilize this production package in his system.

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